

In th Claims:

Please cancel claims 4, 7 9, 10, 14, 17 and 19-46.

Remaining claims are claims 1-3, 5, 6, 8, 11-13, 15, 16, and 18.

1. In a magnetic read head having an air bearing surface (ABS), a magnetic tunnel junction (MTJ) sensor for connection to sense circuitry for detecting changes in electrical resistance within the sensor, the sensor comprising:

a MTJ stack with an active region disposed at the ABS and having two opposite sides each disposed generally orthogonally to the ABS, the MTJ stack comprising:

an antiferromagnetic (AFM) layer spanning the active region,
a pinned layer of ferromagnetic (FM) material in contact with the AFM layer,
a free layer of FM material spanning the active region and extending beyond each of the two opposite sides thereof, and
a tunnel junction layer of electrically nonconductive material disposed between the pinned layer and the free layer in the active region; and
a longitudinal bias layer formed on and in contact with the free layer outside of the active region for biasing the magnetic moment of the free layer in substantially a predetermined direction in the absence of an external magnetic field.

2. The sensor of claim 1 further comprising:

an insulating layer of electrically nonconductive material formed on and in contact with the free layer outside of the active region and in abutting contact with the two opposite sides of the active region.

3. The sensor of claim 2 wherein the longitudinal bias layer is disposed
without contacting the active region.

5. The sensor of claim 3 wherein the longitudinal bias layer comprises an AFM material.

6. The sensor of claim 1 wherein the longitudinal bias layer is disposed without contacting the active region.

8. The sensor of claim 6 wherein the longitudinal bias layer comprises an AFM material.

11. A direct access storage device (DASD) comprising:
a magnetic recording disk having at least one surface for storing magnetically recorded data;
a magnetic read head having an air bearing surface (ABS) disposed for reading the data from the magnetic recording disk surface;
in the magnetic read head, a magnetic tunnel junction (MTJ) sensor comprising:
a MTJ stack with an active region disposed at the ABS and having two opposite sides each disposed generally orthogonally to the ABS, the MTJ stack comprising:
an antiferromagnetic (AFM) layer spanning the active region,
a pinned layer of ferromagnetic (FM) material in contact with the AFM layer,
a free layer of FM material spanning the active region and extending beyond each of the two opposite sides thereof, and
a tunnel junction layer of electrically nonconductive material disposed between the pinned layer and the free layer in the active region;
and
a longitudinal bias layer formed on and in contact with the free layer outside of the active region for biasing the magnetic moment of the free layer in substantially a predetermined direction in the absence of an external magnetic field;

an actuator for moving the magnetic read head across the magnetic recording disk surface to access the data stored thereon; and

a data channel having sense circuitry coupled electrically to the MTJ sensor for detecting changes in resistance of the MTJ sensor caused by rotation of the magnetic moment of the free ferromagnetic layer relative to the fixed magnetic moment of the pinned layer responsive to magnetic fields representing the data stored on the magnet recording disk surface.

12. The DASD of claim 11 further comprising:

an insulating layer of electrically nonconductive material formed on and in contact with the free layer outside of the active region and in abutting contact with the two opposite sides of the active region.

13. The DASD of claim 12 wherein the longitudinal bias layer is disposed without contacting the active region.

15. The DASD of claim 13 wherein the longitudinal bias layer comprises an AFM material.

16. The DASD of claim 11 wherein the longitudinal bias layer is disposed without contacting the active region..

18. The DASD of claim 16 wherein the longitudinal bias layer comprises an AFM material.